

Response to the PCT Written Opinion

10/551732

1) The following opinions were expressed in the Response dated May 25, 2004 issued by the PCT International Searching Authority.

A) Although claim 7 possesses novelty and inventive step, claims 1 to 6 and 8 to 12 possess novelty but do not possess inventive step. As the reason for this, the Examiner is stating as follows: "Document 1 describes a titanium target where, upon heating and recrystallizing the titanium material, the strain is not completely released but rather retained to a certain degree in order to maintain a hard state. With the technology described in Document 1, since the heat treatment temperature for recrystallization is set to a low temperature, it is considered that a non-recrystallized structure exists.

Further, Document 2 describes a tantalum target, and the Examples therein describe technology of manufacturing a tantalum target by performing cold tightening forging – cold upset forging – heat treatment at 1200°C – cold rolling – heat treatment at 1000°C, and thereafter performing machining thereto. Thus, it would be easy to combine this with the technology described in Document 1."

The Documents are as follows:

Document 1: JP09-104972

Document 2: JP11-080942

B) The Examiner also offered the following suggestion: "Claim 8 is an invention relating the manufacturing method of a tantalum target comprising a non-recrystallized structure wherein, after the ultimate plastic working process, this is further subject to annealing at a temperature of 1173K or less. In relation to this,

Comparative Example 1 describes the performance of recrystallization annealing at 1173K, and, since this is the same temperature as Example 5, it would seem that this also comprises a non-recrystallized structure (the same could be said for Comparative Example 3 with a lower temperature). If so, since claim 8 will encompass the Comparative Examples, the invention of claim 8 has no grounds. It is recommended that claim 12 be introduced into claim 8."

C) The Examiner continued by saying, "The comments of B) above also apply to claim 1, and since the tantalum target comprising a non-recrystallized structure will encompass Comparative Example 1 and Comparative Example 3, the invention of claim 1 has no grounds."

2) In light of the Examiner's comments above, our arguments are as follows:

Foremost, with respect to Document 1 (JP09-104972), in conclusion, it is not directed to technology for realizing a non-recrystallized structure. As the Examiner has indicated, although it is true that there is a description of lowering the processing temperature in order to increase the strain, and lowering the heat treatment temperature for recrystallization, these are all based on the premise of obtaining a recrystallized structure. In other words, the heat treatment performed at a low temperature as described above is for making the crystal grains as fine as possible, and is not for obtaining a non-recrystallized structure.

On the front of page 4 of Document 1, several Examples and Comparative Examples are described, and No.1 to No.10 all show clear measurements of the average crystal grains. This is a result of all such Examples and Comparative

Examples being subject to recrystallization annealing. From this fact also, it is evident that Document 1 is not related to technology for obtaining a non-recrystallized structure. With the present invention, since it has a non-recrystallized structure, it is necessary to once again recognize that the crystal grain size cannot be measured (c.f. page 7, lines 1 to 11 of the Description).

By way of reference, there is one example which shows a non-recrystallized structure, which is the Comparative Example of No.11. The Comparative Example of No.11, however, shows no superior operation or effect of a non-recrystallized structure as evident from the following description: "It is clear that this Comparative Example is not favorable since there was a significant generation of particles, and the bottom coverage deteriorated significantly." (c.f. page 4, right column, lines 28 to 31).

Needless to say, since this example is related to a titanium target, it is obvious that the effect of the non-recrystallized structure is not the same as with the present invention. Still, if nothing else, Document 1 has no recognition whatsoever regarding the knowledge concerning a non-recrystallized structure in a tantalum target, and that this yields a significant operation and effect of having a high deposition speed, superior film uniformity and capable of suppressing the generation of arcings and particles.

Therefore, it is clearly erroneous to say that the present invention could have been easily devised based on Document 1.

3) Next, with respect to Document 2 (JP11-080942), as the Examiner has

indicated, this relates to a tantalum target. Nevertheless, Example 1 to Example 6 and Comparative Examples 1, 2 and 4 are all examples where the grain size is within a range of 100 to 500 μm (excluding Comparative Example 3 that could not be used as a target since it cracked during the process).

This technology, as with foregoing Document 1, is for obtaining a structure with a definite crystal grain size, and is not for obtaining a non-recrystallized structure of the present invention. Therefore, it is obvious that the present invention could not have been devised even when combining Document 1 and Document 2.

4) Next, with respect to the issue of Example 5 and Comparative Example 1 and Comparative Example 3 collectively indicated in Table 1 on page 10 of the Description, although the Examiner is stating that Comparative Example 1 and Comparative Example 3 should also have a non-recrystallized structure since the final heat treatment conditions are the same, these are entirely different and the conditions are not the same.

For instance, whereas the purity of tantalum in Example 5 is 3N (99.95%), the purity of tantalum in Comparative Example 1 and Comparative Example 3 is 4N (99.997%), and there is a significant difference with the Comparative Examples 1 and 3 having a higher purity than Example 5.

Comparative Example 1 and Comparative Example 3 having a higher purity begin to recrystallize from 825°C (1098K), and, ordinarily, recrystallization will advance sufficiently at 850°C (1123K) to 900°C (1173K). Meanwhile, with

Example 5 having a low purity, recrystallization will not occur unless it is subject to a higher temperature. In other words, it will not recrystallize at 900°C (1173K), and recrystallization will be achieved at 1050°C (1323K).

Therefore, Example 5 and Comparative Examples 1 and 3 are clearly different, and Comparative Example 1 and Comparative Example 3 do not have a non-recrystallized structure. Thus, there is no discrepancy whatsoever between claim 1 and claim 8, or among Example 5, Comparative Example 1 and Comparative Example 3, and there are no problems with the grounds of the present invention.

5) Accordingly, the invention of the present PCT application could not have been easily devised based on the technology described in cited Documents 1 and 2, and obviously possesses novelty and inventive step over the conventional art. Further, there is no problem regarding the descriptions of the Examples and Comparative Examples as the background of the present invention, and they provide sufficient technical grounds.

Thus, we believe that the present invention possesses patentability.